STONEVILLE . . . A GREAT PLACE TO DO RESEARCH

Jamie Whitten Delta States Research Center

Stoneville, Mississippi

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The Jamie Whitten Delta States Research Center, in Stoneville, Mississippi, is a world leader in agricultural research. Strategically located in the Lower Mississippi Flood Plain, the center is situated in one of the most important agricultural regions in the United States. The center is part of the Agricultural Research Service, the U.S. Department of Agriculture's chief scientific research agency.

Research here starts in the laboratory, moves to the field, and finishes in the world marketplace. Scientists at the center conduct fundamental and problem-solving research representing an array of scientific disciplines, among them, biotechnology, biology, genetics, engineering, chemistry, ecology, entomology, physiology, biochemistry, weed science, botany, agronomy, aquaculture, soil science, and plant pathology. This multidisciplinary approach is aimed at increasing efficiency in producing and processing agricultural products to the benefit of both farmers and consumers.

With numerous resources readily available, Stoneville scientists have a unique opportunity to work cooperatively with many local, state, Federal, and private sector groups. The center is situated on 1,450 acres of state and Federal land. Together the ARS center, the Mississippi Delta Research and Extension Center, and the USDA Forest Service's Hardwoods Laboratory form one of the largest off-campus research, education, and extension centers in the United States. The state-of-the art Thad Cochran Aquaculture Research Center is run jointly by ARS and Mississippi State University.

The research center serves as headquarters for ARS' Mid South Area, which manages research locations in Mississippi, Louisiana, Alabama, Kentucky, and Tennessee. The Whitten Center comprises seven ARS research units. The research projects in these units encompass plant genetics and physiology, ways to control crop pests, agricultural production systems and techniques, the creation of new and improved equipment, human safety and health, the economic well-being of agricultural producers and consumers, and the technology of pesticide application.

With New Technology . . .

Application and Production Technology Research Unit scientists develop new equipment and innovative cultural and agronomic practices for ensuring the safe, accurate, and timely application of agrichemicals to crops with the least environmental impact. They also develop new crop production systems that use technology and equipment designed specifically for a site in order to optimize agronomic inputs and land and water resources.

High-tech sprayer zaps weeds with less herbicide by using a light sensor that scours the ground for weeds and kills them, using less herbicide than conventional sprayers (see photo above). Developed cooperatively with industry, the eight-row hooded sprayer uses its sensor to distinguish differences in light reflected from bare soil versus weeds between crop rows. It then applies herbicides only where weeds are present.

Ultra-low-volume (ULV) sprayers reduce pesticides and allow for equal distribution of pesticides, while also reducing the amount of spray that drifts into other areas. Used with malathion for boll weevil control, ULV sprayers decrease application rates, which results in significant cost savings and reduces environmental impact.

Catfish Genetics Research Unit scientists work to identify economically important traits in catfish that will make a better consumer product. The facilities include 40 ponds and more than 500 tanks, which help researchers develop new breeding strategies that will improve commercial production for catfish farmers.

Better catfish for consumers. Thanks to traditional breeding methods researchers are now able to select superior catfish. Stoneville scientists have developed a new catfish strain that shows faster growth, increased feed consumption, and improved reproductive performance. They have also developed genetic markers that allow them to identify these fish and map the catfish genome. This information will help in identifying important traits for breeding catfish and, ultimately, will improve the quality of farm-raised catfish.

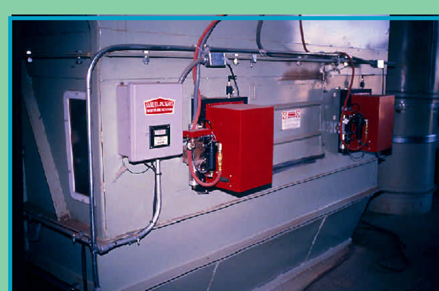
X-rays show how much food catfish eat. Through the use of tiny, opaque glass beads that show up on x-ray, scientists can calculate how much food a fish has eaten by counting the number of beads in its stomach. This method, originally produced for salmon-type fish, allows researchers to identify fish with superior feed intake. It also helps in determining which fish efficiently turn their food into fillet meat.

This saves fish farmers money in feed costs and, in the end, gives consumers a better catfish product.

U.S. Cotton Ginning Laboratory. Since 1931, scientists in this unit have developed equipment and methods for improving ginning, such as the tower dryer, stick machine, and lint cleaner. They have even developed machines to replace broken ties that hold the cotton bale together. Most gin equipment in use today started from this lab. Researchers here work to develop new technology and evaluate existing know-how covering different cotton varieties, production practices, harvesting methods, ginning, and milling. This work helps assure low-cost, high-quality consumer products and an adequate financial return to cotton growers.

Gin school is in for ginners and students who want to learn about the latest gin technologies. Stoneville scientists conduct schools annually to transfer ARS and other technologies to the gin industry, including new developments in cotton drying and cleaning, bale packaging, air and noise pollution, and fiber quality improvements. Hands-on training on a unique microgin greatly enhances students' experience.

IntelliGin™ is a new computerized system that automatically measures cotton quality during ginning, thereby improving profits and maintaining high fiber quality. Developed by Stoneville scientists, the system, which is now available commercially, uses sensors to determine cotton quality. It then sends the information to a computer and routes the cotton through the appropriate cleaning and drying sequences.



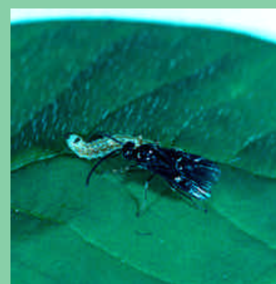
The Crop Genetics & Production Research Unit conducts research on the genetics and physiology of cotton, corn, and soybeans to improve yields, quality, and food safety. The scientists in this unit produce new combinations of genes and develop crop management systems that are environmentally safe, result in greater crop profitability, and make U.S. agriculture more competitive in world markets. They coordinate, analyze, evaluate, and report results on new technology and germplasm from the National Cotton Variety Tests and the Southern Uniform Soybean Tests.

The Genetics Technology Unit uses conventional and genomic genetic approaches to improve U.S. cotton and soybeans. Since 1952, Stoneville researchers have produced 29 new high-yielding soybean varieties and 24 new germplasm lines. Development of the nectarless trait in cotton means this plant produces less nectar, thereby attracting far fewer major insect pests. Germplasm releases of both soybeans and cotton have improved their yields, quality, and pest resistance. Almost all soybean and cotton varieties used in the five-state Mid South Region stem from ARS germplasm.

New crop management technology. An early soybean production system, developed by Stoneville scientists, has increased crop yields in the Mid South by about five bushels per acre just by planting soy-

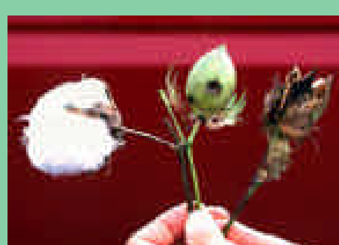
beans earlier, using earlier maturing varieties. Cotton scientists discovered that by employing narrower row spacing and by genetically modifying the cotton plant, farmers can avoid environmental stresses and insect pests and can increase crop yields.

WHAT'S BUGGING FARMERS . . .



Southern Insect Management Research Unit scientists conduct basic and applied research on major crop pests, like the cotton bollworm (*Helicoverpa zea*), tobacco budworm (*Heliothis virescens*), plant bug species, cotton aphids, and the boll weevil. They develop new and improved control strategies and establish fundamental principles for the more effective encouragement and use of natural enemies, such as predators and parasites.

Monitoring insect resistance to transgenic cotton. In 1996, industry released transgenic cotton made with the toxic proteins found in the bacterium *Bacillus thuringiensis* (*Bt*), which prevent bollworms and tobacco budworms from damaging valuable cotton crops. ARS scientists monitor field populations of these pests for changes in their tolerance to *Bt* cotton, recommending remedial action to delay widescale resistance and striving to maintain this technology in order to preserve the profitability of cotton for years to come. A major focus of study are the genetic mechanisms of resistance in bollworms and tobacco budworms.



Other work entails keeping pests in check, while trying to save growers money and reduce insecticide spraying. In the 1980s, scientists here demonstrated that the tarnished plant bug (*Lygus lineolaris*), an economically damaging cotton pest, had become resistant to pyrethroids, a class of insecticides commonly used to control them. In response, researchers initiated an areawide project to study noninsecticidal ways to manage the pest, including elimination of wild, early-season host plants, biological control, and nectariless cottons.

Weeding Out Problems . . .

Southern Weed Science Research Unit scientists find safe, efficient, and economical approaches for managing weeds. This can mean the difference between farmers' profits or losses, because weeds that compete with crops can reduce yields and lower quality. The research in this unit focuses on developing sustainable integrated weed control systems, based on biological practices that decrease reliance on synthetic herbicides and improve soil and water resources.

Working with nature to combat weeds. Stoneville scientists discovered several disease-causing plant fungi and bacteria that attack and kill weeds. One such fungus that may help farmers—*Colletotrichum truncatum*—controls hemp sesbania, an important weed in cotton, soybeans, and rice. Using plants' natural enemies offers environmentally safe ways to help manage weeds.

Helping Delta farmers. Researchers in the Mississippi Delta show farmers how to use conservation practices such as reduced tillage, crop rotation, and narrow rows to help manage weeds, save money, and enhance soil and water quality. Weed scientists here found, for example, that farmers can cut herbicide applications in half and still suppress weeds and increase crop yields by planting soybeans in ultranarrow rows or by planting herbicide-resistant soybeans. Using some of these practices also reduces runoff to area lakes, thereby promoting a balanced aquatic community.

NATURALLY . . .

Biological Control and Mass-Rearing Research Unit scientists identify important biological control agents, develop systems for mass-rearing them, and find ways to use them in the management of insect and weed pests. Scientists in the Stoneville Research Quarantine Facility study exotic natural enemies, including potential biological control agents of exotic weeds like the tropical soda apple and agents of the Formosan subterranean termite and red imported fire ant. Work also focuses on development of artificial diets for insect biological control agents.

Attacking exotic weeds. Tropical soda apple is a noxious exotic weed from South America that has become established in the Southeastern United States. Even though the weed is attacked by numerous insects here, it continues to expand its range and to

cause damage, particularly in pastures. Scientists in the Southern Weed Science Research Unit are exploring the weed's ancestral site of origin for its natural enemies. The most effective natural enemies will be imported for clearance through the Stoneville quarantine facility.

The Formosan subterranean termite is from southern China but is causing significant damage in a number of U.S. port cities. Scientists are conducting explorations in China to identify, collect, import, and evaluate potential biological control agents for this important pest, and to integrate biological control methods into management practices.

Better food for bugs. Researchers are working to develop and improve artificial diets for important insects, especially potential biological control agents. A recently patented diet for entomophagous insects—insects that eat other insects—was licensed for use in commercial insectaries for the mass-rearing of green lacewings. Other work includes efforts to automate diet preparation and packaging.

WEB SITE . . .

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TO DO RESEARCH

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ARS Mission As the principle in-house research arm of the U.S. Department of Agriculture, ARS conducts research to develop and transfer solutions to agricultural problems of high national priority and provides information access and dissemination to—ensure high-quality, safe food and other agricultural products; assess the nutritional needs of Americans; sustain a competitive agricultual economy; enhance the natural resource base and the environment; and provide economic opportunities for rural citizens, communities, and society as a whole. For more information about ARS, visit the web site at **www.ars.usda.gov/**